

## Characterization and Monitoring of Microbial Species in the International Space Station Drinking Water

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The focus of this study is to develop procedure(s) to characterize the microbial quality of the drinking water for the International Space Station (ISS) and shuttle at various stages of water treatment. Adapted procedures were developed by the Mars Technology Program and were implemented through AEMC program. Such procedures should be robust and rapid as well as simple. This report is the first document on the molecular microbial analysis of drinking water processed for the ISS. We propose here the cataloging of prevalent microbial species that are both cultivable and non-cultivable using existing advanced molecular and enzymatic approaches. Once such microbial diversities are characterized, we will suggest ways of minimizing and/or preventing the likelihood of on-board illness.

Drinking water processed at various stages for the STS-113 mission aboard the Endeavor OV-105 shuttle, as well as aboard the ISS, was sampled and examined for microbial contamination using state of the art quantitative and qualitative methodologies. The microbial detection procedures utilized in this study were both conventional and NASA-developed methods. Enzyme-based microbial detection methods (ATP and LAL) revealed the presence of non-cultivable microbes in the drinking water, and confirmed the fact that the measures taken to cultivate microbes from the drinking water samples were estimating only 10% of the microbial contamination. It is interesting to note that both culture and DNA-based methodologies reported the presence of *Acidovorax temperans*, a halogen (biocide) reducing bacterium from the ISS-regenerated water sample. Although the water collected from the drinking fountain did not contain any measurable microbes, the DNA-based procedures retrieved ribosomal sequences of opportunistic pathogens, *Afipia*, *Deftia*, *Propionibacterium*, and *Ochrobactrum*. The present study did not confirm the presence of active pathogens in the drinking water, however, evidence strongly suggests that implementation of new cultivation approaches to identify the presence of pathogens is crucial.